Cost and Risk Management Technology Element

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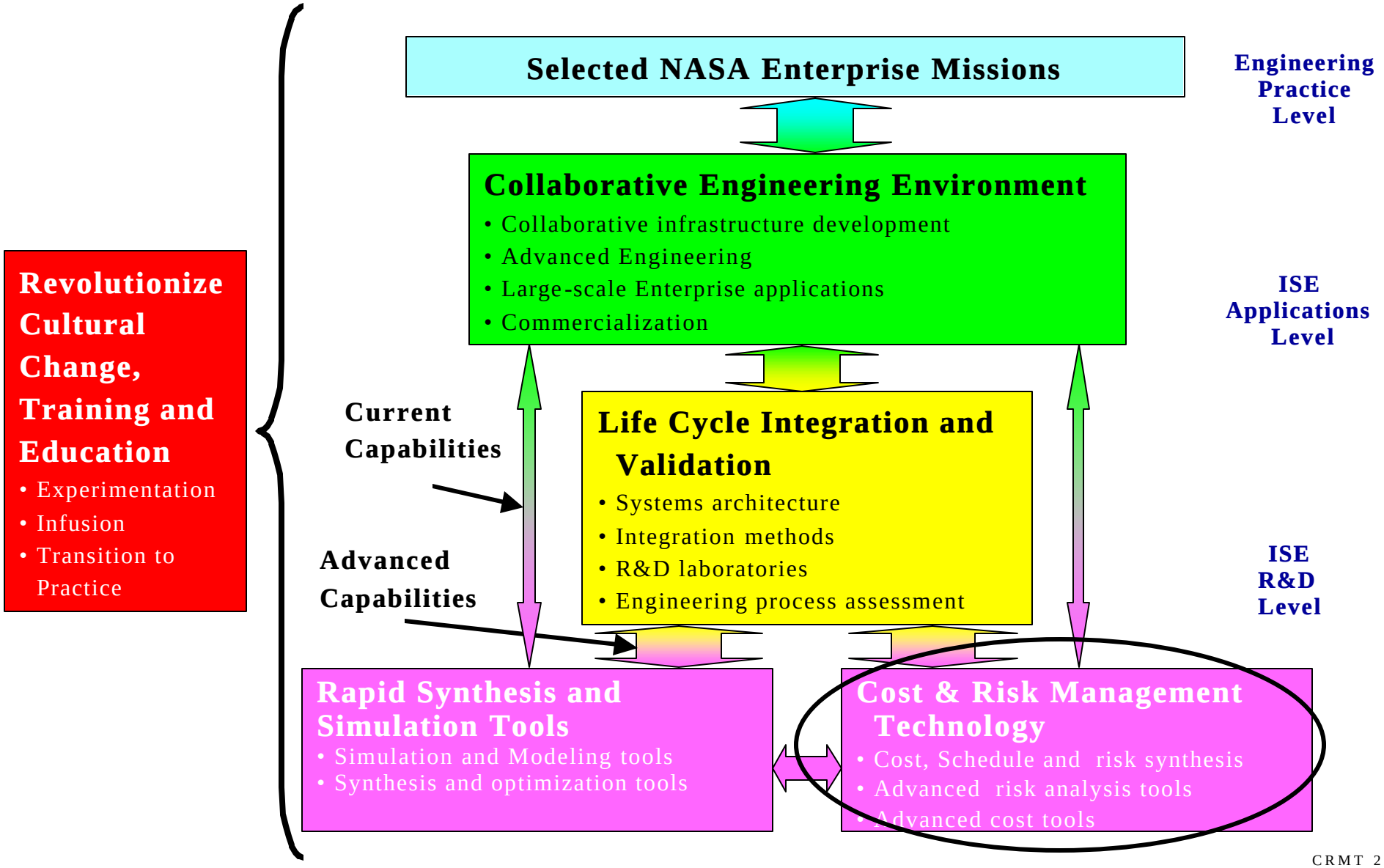
Relationship Between ISE Elements

Intelligent Synthesis Environment Industry/Academia Workshop



Cost and Risk Management Technology Background

Historical Perspective

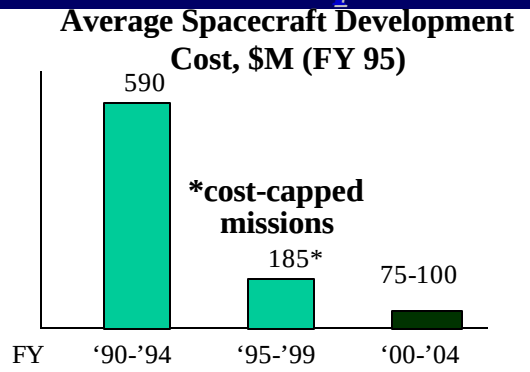
- NASA's mission is inherently challenging
- Predicting cost and schedule and mitigating NASA's risks is a challenge
  - NASA's has a history of cost and schedule overruns
  - First launch success rate for launch vehicles is ~ 50%

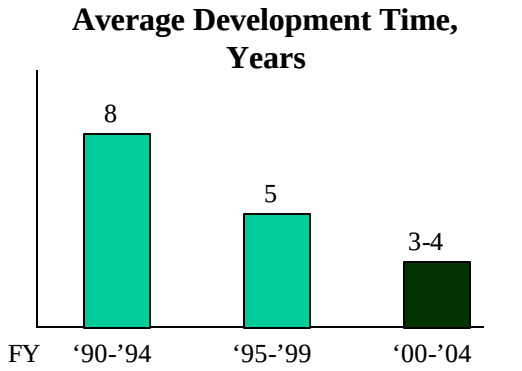
Present

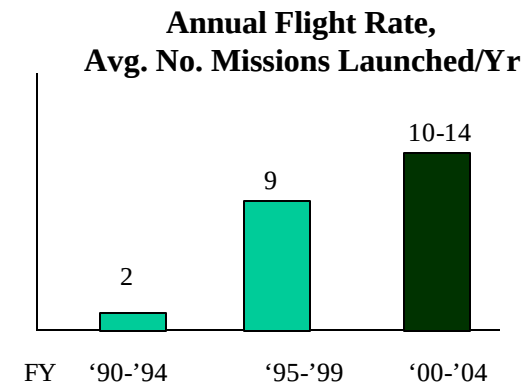
- Era of "Better, Faster, Cheaper" and changing business practices
  - Safety is the number one priority of the Agency
  - Cost- and schedule-constrained missions
  - Science program emphasis on frequent launches of small missions
  - Technology demonstrators and X-vehicles

Future

NASA's challenge for the 21st Century is to maximize science return and technology investments in space and aeronautics at **affordable cost** and **minimal risk**







Cost and Risk Management Technology Goals and Challenges

Goals

- Establish a basis for trades between performance, cost, schedule and risk parameters
- Provide NASA with reliable life cycle cost and risk management tools, models and methodologies early and throughout the life cycle

Challenges

- Cost and risk toolset across all mission types and over the full life cycle does not presently exist with desired fidelity
- **Cost and risk methods not support rapid assessment of future missions and advanced technology**
- Perceived reliability of cost and risk tools, models and methods is not well understood
- Integration of cost and risk disciplines into the design space is a non-traditional way of doing business

CRMT VISION

Enhance the decision-making process by the infusion of relevant and timely cost, economic, schedule and risk information throughout the system life cycle

Cost and Risk Management Technology Approach

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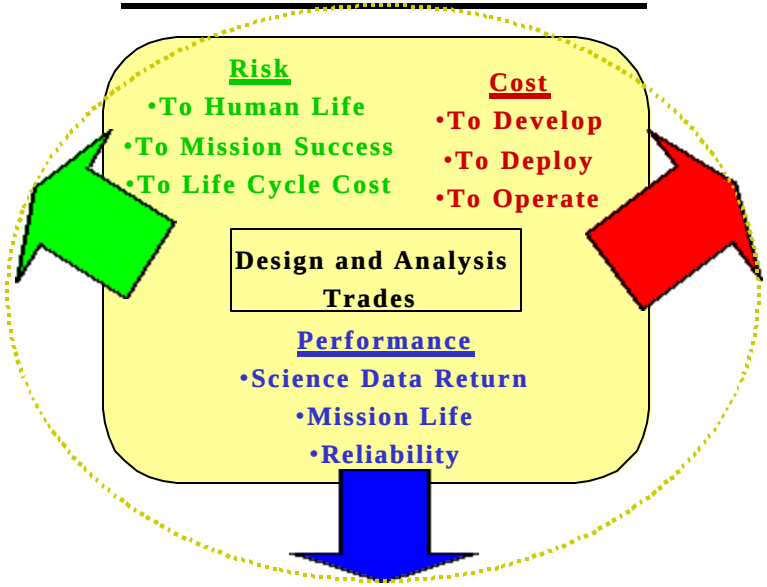
THE INTEGRATION OF COST, SCHEDULE AND RISK DATA INTO THE LIFE CYCLE DESIGN AND ANALYSIS TRADE SPACE IS A MAJOR CULTURE SHIFT

NASA's Current Practice



NASA's Future Life Cycle Analysis

- Reliable, high-fidelity predictive capabilities are needed to provide total life-cycle cost and risk analyses for rapid assessments of all mission types in all program phases

- Establish connectivity between cost, schedule, risk and performance parameters
  Performance, cost, schedule and risk analyses are loosely coupled under current practices

5-Year Targets

- Focused Research
  - Pathfinder investigations/demonstrations of non-traditional methods applied to cost, schedule, risk models
  - Pathfinder investigations/demonstrations of ISE technologies (I.e., visualization, advanced information technology, etc.) applied to cost, schedule, risk models

- Updated toolkit to model Life Cycle Cost (LCC) for NASA systems
  - Documented tools
  - Compatibility of cost processes and tools with performance tools, methods and processes facilitated
  - Cost processes and tools integrated into advanced environments in collaboration with LCIV and CEE

- Updated risk management toolkit to support Agency risk management initiatives
  - Emphasis on analyzing risk early and tracking risk throughout the life cycle
  - Compatibility of risk management processes and tools with performance tools, methods and processes facilitated
  - Documented tools
  - Risk management processes and tools integrated into advanced environments in collaboration with LCIV and CEE

Critical Technology Challenges

- **Fundamental cultural issues exist with both risk management and cost estimating analysis within the design and analysis function**
  - Typically regard as systems engineering and management functions, not part of design and analysis
  - These functions/disciplines are generally not well understood by the engineering and scientific communities
- **Credibility Gap**
  - Cost and risk models are difficult to validate (not validated by experimental data)
  - Not physics-based
  - Technical variances propagate to risk, schedule and cost (ex: weight growth, power margins, etc.)
  - Systems estimated is often not the system acquired (requirements change)
- **Data Issues**
  - Proprietary issues; data integrity; data obsolescence
  - Modeling capability is highly dependent on historical data
- **Integration of cost and risk into the design space**
  - Cultural issues (common language, lack of understanding, cultural boundaries etc)
  - Acceptance issues
  - Parameter space becomes very large
  - Cost and risk analyses are performed last at the end of a sequential process

Technology Needs

- **Cost, Schedule and Risk Synthesis**
  - Integration standards and protocols
  - Synthesis methods and architectures
  - Validation methods
  - Advanced data/knowledgebase technologies
  - ISE technologies applied to cost and risk management processes

- **Advanced Risk Analysis Tools**
  - Advanced methods applied to risk analysis tools and processes
  - Algorithm development

- **Advanced Cost Tools**
  - Advanced methods applied to cost analysis tools and processes
  - Algorithm development

CRMT Organizational Structure

Intelligent Synthesis Environment

COST AND RISK MANAGEMENT TECHNOLOGY (CRMT)
Manager: Arlene Moore, LaRC
Deputy Manager: Kelley Cyr, JSC

CRMT MANAGEMENT TEAM
Team Lead: Arlene Moore
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Andy Prince, MSFC
Bob Sefcik, GRC
David Shelton, KSC
Bob Shishko, JPL
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CRMT TECHNICAL WORKING GROUP
Group Leader: Kelley Cyr

Large Scale Application Leads
STS - Dave Shelton, KSC
ISS - Bob Shishko, JPL
RSTS - Andy Prince, MSFC
IE/S - Keith Warfield, JPL
Advanced EOS - Ted Hammer, GSFC

Summary

- **NASA's challenge for the 21st Century is to maximize science and technology investments in space and aeronautics at affordable cost and minimal risk**

- **CRMT will provide a cost and risk analysis capability consisting of:**
  - Advanced cost and risk management tools
    - Compatible with an Agency-wide collaborative infrastructure and engineering environment
    - Integrated, validated and tested in relevant environments
    - Demonstrated and put into practice on multiple mission life-cycles
  - Ability to synthesize cost, schedule, and risk information within the engineering design process